PART III

Physical Description

Physical Regions of Washington

On the basis of surface features, Washington may be divided into eight general regions. Agricultural settlement is influenced by factors of topography, climate, soil, forest vegetation and water resources distinctive to each of the physiographic regions. Each has become a different type of farming area as settlers have learned to adapt crops and livestock to the conditions, or have improved limitations through drainage or irrigation.

Coastal Plains

A narrow, sandy plain with shallow bays, tidal flats, stream deltas and low headlands lies between the coastline and the Coast Range. It extends from the Columbia River mouth almost to Cape Flattery, being widest and lowest in the Grays Harbor and Willapa Bay districts. The climate is mild and damp with a long growing season, but it is too cool, cloudy and wet for most crops. Originally this area was covered with heavy forests and much is now covered with woodlands. Lumbering and manufacture of wood products is the main industry. Farming is largely of the livestock and dairying type on low uplands and drained areas in the lower Chehalis River Valley. Cranberry growing is important and well-adapted to numerous, boggy areas in the Grays Harbor and Willapa Bay sections. The shallow bays are also used for oyster culture. Fishing is common in the rivers and coastal banks.

Coast Range

The Coast Range is an uplifted area of sedimentary and metamorphic rocks divided into the Olympic Mountains and the Willapa Hills. The Olympics tower to nearly 8,000 feet in a dome-like structure, carved deeply by rivers. These mountains have the heaviest precipitation in the state. Snowfields and heavy forest cover the mountains. Most of the wilderness area is within the Olympic National Forest and Olympic National Park, being managed for recreation, wildlife and timber. Farm settlement is limited to some foothill river plains and coastal terraces such as the Dungeness and Port Angeles districts along the Strait of Juan De Fuca. Here in the lee of the mountains, rainfall is moderate and irrigation is practiced by some livestock farmers. The Willapa Hills country is wet, heavily forested and carved into numerous narrow valleys. Logging is the main industry, combined with livestock farming in the upper Chehalis River Valley and along the banks of the Columbia River. Wet climate, hilly topography and the difficulty of clearing stump land retards agriculture.

Willamette-Puget Sound Lowland

A broad lowland, described as a trough or valley, lies between the Coast Range and the Cascade Mountains. The northern part is the Puget Sound Lowland which has been glaciated and occupied by the sea in the lowest section. The continental glacier reached slightly south of Olympia. Under a warming climate it melted and geologists believe it receded about 25,000 years ago, leaving an infertile plain of moraines and outwash gravels, sands and clays known today

as the Puget Glacial Drift Plain. Its rolling surface has numerous lakes and bogs. Most of the major cities--Seattle, Tacoma, Everett, Bellingham and Olympia--have been built on moraines bordering the Sound. Rivers, such as the Nooksack, Skagit, Snoqualmie, White and Puyallup, built up deltas and flood plains over the older gravelly plains. These narrow valleys are more fertile than the older glacial plains and support numerous small dairy, vegetable and berry farms. Most of the gravelly areas are wooded with a second-growth forest and are used for pastures. In the southern part of the Willamette-Puget Sound Lowland, there are two large valleys--the Cowlitz and Chehalis. They drain a low, hilly area with several flat prairies and bottom lands.

Agriculture is handicapped by poor drainage and flooding of the river deltas and plains, by heavy winter rainfall, by cloudy but dry summers, by coarse, gravelly upland soils and by densely wooded land which is costly to clear. Advantages are mild climate and a location close to major markets for farm products such as milk, poultry and vegetables.

Cascade Mountains

The Cascades are a wide and high topographic and climatic barrier which separates western and eastern Washington. The range is made up of sedimentary, igneous and metamorphic rocks which have been carved by glaciers and streams. High, isolated volcanic cones of lava such as Mt. Adams (12,307 feet), Mt. Rainier (14,408 feet) and Mt. Baker (10,791 feet) appear upon the older Cascade rocks. The Cascade crest varies between 3,000 and 10,000 feet and is higher and more rugged in northern Washington. Roads and railroads have been built across its lower passes in central and southern Washington. The Columbia River has cut a deep gorge and the lowest pass through the barrier. The western slope is wet and heavily forested with Douglas fir. The eastern slope is drier with a less-dense pine forest. Nearly all classified as forest land, most of the area is in Federal ownership in five national forests and Mount Rainier National Park. Tree fruit farming in the eastern slope valleys of Wenatchee, Chelan, Methow, Naches and the Columbia Gorge is most important. Sheep and cattle summer grazing on alpine grasslands is another use. Deep western slope valley bottoms such as the Skagit, Snoqualmie, Nisqually, Cowlitz and Lewis also contain livestock farms. The area is vitally important as a source of timber. Steep terrain, wet climate, short growing seasons and heavy forest vegetation are main handicaps for agriculture.

Columbia Basin

A low plateau of old lava rocks covered with stream and wind-deposited soils extends in a series of plains, ridges, coulees and hills from the Cascades to the eastern Washington border. The area is basin-like in structure, being higher around its margins and sloping inward to low and level central plains. It has been sharply eroded by the Columbia River and its interior tributaries, the Snake, Yakima, Palouse and Spokane Rivers. The basin has sub-areas created by crustal movements and erosion.

The Yakima Folds are a series of hilly ridges extending from the Cascades eastward into the lower part of the basin. The Yakima and Columbia Rivers have cut gaps through the ridges and built up plains in the troughs between them. The rich, alluvial plain of the Yakima River is an important irrigated valley.

The Waterville Plateau is a tableland of thin soils overlaying basaltic rock at an elevation of 2,500 to 3,000 feet. It has gorges cut by the Columbia River and ancient glacial outwash streams once flowing in Moses and Grand Coulees. It is too high for irrigation and is used for dryland grain and livestock farming. The high plain is often called the Big Bend country.

The Channelled Scablands is a belt of dry terrain carved by ice-age rivers into a series of coulees. Bare rock is exposed in the coulees. Small plateaus between the old river channels have thin soils used for dryland farming. The Grand Coulee of this region has been developed into a major irrigation reservoir.

The Palouse Hills consist of fertile deposits of wind-blown soil overlaying basaltic lava flows. After being deposited in large dunes, the formation was reshaped by streams into an intricate pattern of low, rounded hills which are tilled for wheat, barley and legumes. The hills receive 16 to 25 inches of rainfall and have deep, porous and fertile soils. It is one of the richest farming areas of the Pacific Northwest.

The Central Plains are low and relatively level expanses of soil, deposited by old streams crossing the Channelled Scablands and later by the flooding of the Yakima, Columbia, Snake and Walla Walla Rivers. Climate is desert-like (6-12 inches of precipitation per year). The lower lands of the area, the Quincy and Pasco Basins and the Walla Walla Valley, are irrigated. Quincy Basin is a new irrigation area watered by Grand Coulee Dam.

Agricultural handicaps in Columbia Basin regions are mainly found in its dry, continental climate. Large irrigation systems built since 1900 have overcome much of the need for water on rich valley and basin soils. Dryland farming in higher areas is practiced widely, although occasional variations in rainfall, lack of snowfall, winter-kill, water and wind erosion inflict damage to field crops and to livestock ranges.

Okanogan Highlands

A portion of the Rocky Mountains, consisting of well-eroded old granites, lavas and sedimentary rocks, extends across north central Washington. These are the Okanogan Highlands, the state's richest mineral area. Summit levels reach 4,000 to 5,000 feet with peaks exceeding 7,000 feet. Prominent north-south valleys are occupied by irrigated tree fruit and livestock farms. These are the Okanogan, Sanpoil, Kettle and Colville Valleys. The Columbia River Gorge through the Okanogan Highlands is occupied by the large man-made lake behind Grand Coulee Dam--Roosevelt Lake. High and wetter portions are forested with pine and larch, and are managed for timber and for livestock ranges by the United States Forest Service and the Bureau of Indian Affairs. Cold winter temperatures, short growing seasons, dry valley climates and distance from markets are farming handicaps.

Selkirk Mountains

The Selkirks, a range of the Rocky Mountain system, extend into the northeast corner of Washington. The rocks are old mineralized granites and metamorphics reaching elevations of over 7,000 feet. The Pend Oreille River Valley

at the base of the Selkirks is an agricultural area of narrow bottom lands settled by livestock farmers. Nearly all of the uplands are in Kaniksu National Forest. While climate is cool and growing seasons are short, the Pend Oreille Valley has an advantage of being closely located to the Spokane metropolitan market area.

Blue Mountains

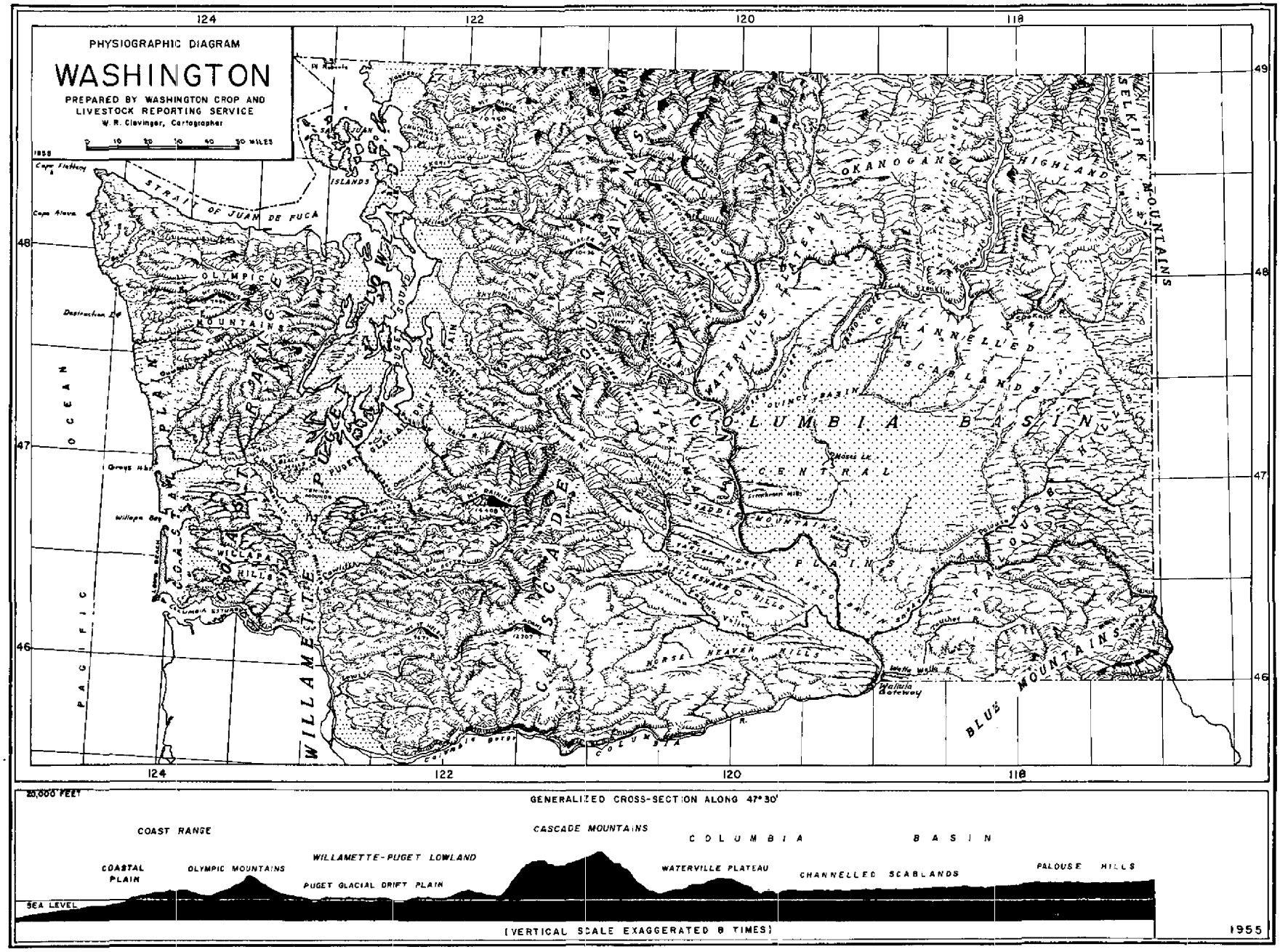
The Blue Mountains are an uplifted and eroded plateau extending into the southeastern corner of Washington. The strata are mainly ancient crystalline rocks which contain some minerals. The highest point of the mountains in the Washington section is Diamond Peak (6,401 feet), on the divide between the Grande Ronde, Tucannon and Touchet Rivers. These rivers, and the Walla Walla River, have cut valleys into the plateau. Extensive pine forest and grassland areas are in the highlands within Umatilla National Forest, where rainfall is 30 to 40 inches. The Snake River has cut a deep valley and gorge across the lower parts of the mountains. The area is well developed agriculturally around its northern foothills where wind-blown soils are deep and irrigation systems are used. The Walla Walla and Tucannon Valleys are rich grain, legume and livestock areas grown under irrigation and by dry farming. Grazing is an important use of the high lands by livestock ranchers in the upper valleys.

Topography of San Juan County

San Juan County consists of an archipelago of 172 islands which are varied in size and topography. There are numerous uninhabited rocky islets and reefs and population and agriculture are located on less than 30 of the major islands. The islands are essentially a range of partially submerged hills and folded ridges connecting Vancouver Island to the mainland, being part of an uplifted and folded strata of sandstone and limestones related to the Vancouver Island formation. The higher portions of this submerged chain of hills appear as the larger islands such as San Juan, Orcas, Lopez, Shaw, Blakely and Decatur Islands. There are numerous small islands which are the tops of low, rounded hills.

Topography varies by islands. Orcas Island has the greatest range of elevation and the most varied relief and irregularity of shoreline. Eastern Orcas Island is hilly, rising abruptly out of the sea, and contains Mount Constitution, the county's highest point at 2,409 feet. San Juan, Lopez and Shaw Islands are primarily rolling plateaus with localized hills of less than 500 feet above sea level. Blakely and Decatur Islands are hilly while some of the small outer islands such as Barnes, Clark and Patos are low and mainly less than 100 feet above high tide water. A varied landscape of channels, bays, sheltered sounds, small islands and hilly major islands makes the region one of high scenic quality.

Surfaces of the islands have been mainly shaped by the erosion and deposition of the Vashon glaciation which occurred in the Puget Sound Basin about 20,000 years ago, according to geologists. The ice sheet, moving southward from sources in British Columbia mountains, scoured Orcas Island and leveled off the surfaces of San Juan and Lopez Islands. Deep glaciers carved some of the valleys in between the islands which are ocean channels today and some of the lakes on Orcas and Blakely Islands. Parts of the islands were believed to


PHYSIOGRAPHIC DIAGRAM
WASHINGTON
PREPARED BY WASHINGTON CROP AND LIVESTOCK REPORTING SERVICE
W. R. Clevinger, Cartographer
1955
124
122
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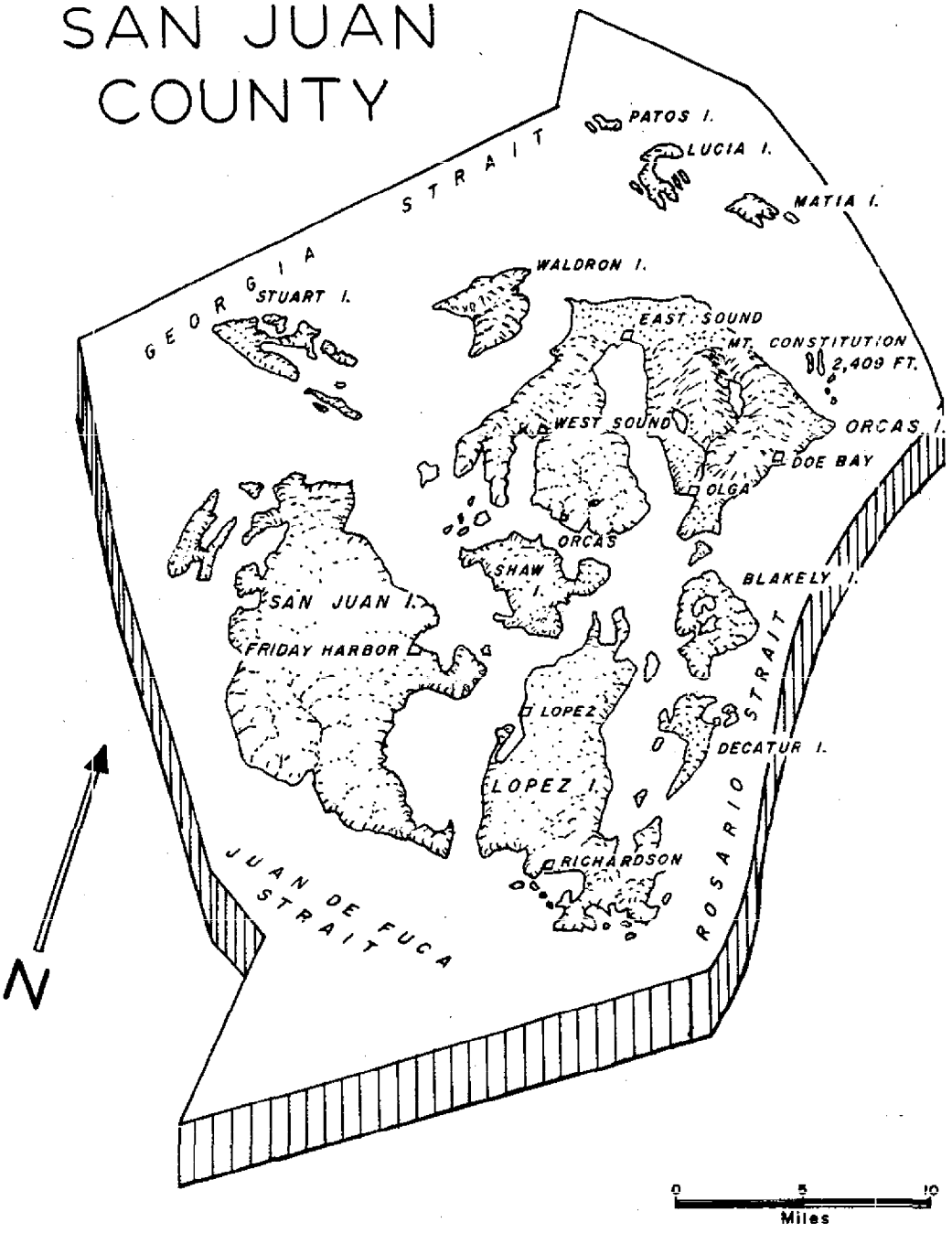
PACIFIC OCEAN
STRAIT OF JUAN DE FUCA
SAN JUAN ISLANDS
OLYMPIC MOUNTAINS
COAST RANGE
PUGET SOUND
WILLAMETTE-PUGET LOWLAND
PUGET GLACIAL DRIFT PLAIN
WILLAPA HILLS
CASCADE MOUNTAINS
OKANOGAN HIGHLAND
SELKIRK MOUNTAINS
COLUMBIA BASIN
WATERVILLE PLATEAU
CHANNELLED SCABLANDS
CENTRAL PLAINS
PALOUSE HILLS
BLUE MOUNTAINS
YAKIMA RIDGE
HORSE HEAVEN HILLS
COLUMBIA
Walla Walla Gateway
GENERALIZED CROSS-SECTION ALONG 47° 30'
20,000 FEET
SEA LEVEL
COAST RANGE
COASTAL PLAIN
OLYMPIC MOUNTAINS
WILLAMETTE-PUGET LOWLAND
PUGET GLACIAL DRIFT PLAIN
CASCADE MOUNTAINS
COLUMBIA BASIN
WATERVILLE PLATEAU
CHANNELLED SCABLANDS
PALOUSE HILLS
(VERTICAL SCALE EXAGGERATED 8 TIMES)
1955

SAN JUAN COUNTY



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have been below sea level at the end of the ice age and ocean sediments were deposited in gradual sloping beds. Since the ice sheet receded, it is believed the lower elevation parts of the islands have risen above the sea. The channels and surrounding waters in the archipelago are relatively shallow. Tidal currents in the channels, however, tend to keep the inter-island gaps at navigable depths. The existing surface is primarily the result of glaciation and some wind erosion. There has been very little river or stream development to shape topography and deposit plains of sediment. Most streams are intermittent, being dry in the summer. Marine sediments and old lake beds are more common. Many of the soil deposits have been formed by gradual disintegration of the underlying rock strata, and in most hilly places bedrock is exposed. Good exposure of limestone and sandstone early attracted building stone, limestone and cement industries.

Land Classification and Soils

San Juan County land is broadly divided into seven general classes of capability for agricultural use. Only a minor part of the total land area is capable of use for cultivated crops. Over three-fourths is capable for economic use only as grazing land or woodland. Limiting factors are hilly terrain, thin soils and lack of top soil moisture during the summer dry season. Soils are varied and are mainly of glacial, marine and forest types. The land class and soil type situation has influenced farmers to adopt livestock grazing and grassland farming and some tree crops and woodland management as most successful forms of land utilization.

Class II, III and IV land, consisting of level and gradually sloping prairies suitable for cultivated crops and improved pastures, is limited to small areas on the larger islands. Most of Lopez Island is Class III and IV lands but less than half of San Juan and Orcas Islands are in these land classifications. About one-third of Orcas and San Juan Islands are in land classifications of V, VI and VII which are only suited for grazing or woodlands. The other smaller islands such as Shaw, Blakely, Decatur, Waldron and Stuart are hilly, and with exception of small acreages, are in poor or nonagricultural land classifications. Orchards and pastures are found in some of the sloping and rocky districts.

Important soils in the islands are the Bellingham, Bow, Coveland and Roche series of loams. Bellingham silt loam, one of the best soils, is formed of fine textured glacial silts and clays and occurs near the center of San Juan Island and in northern Orcas Island in small, poorly drained plains. Bow silt loam is found on gently sloping foothills and was formerly covered with Douglas fir forest and underbrush. It occurs on all the islands. Coveland silt loam is a glacial and lake bed soil found adjacent to bays and inlets and is a good grassland soil where properly drained. Roche loam is a common upland soil formed from glacial drift and under Douglas fir forest cover. Soils vary from point to point and do not occur in large uniform areas such as are found in the major river valleys of the mainland in Skagit and Whatcom Counties.

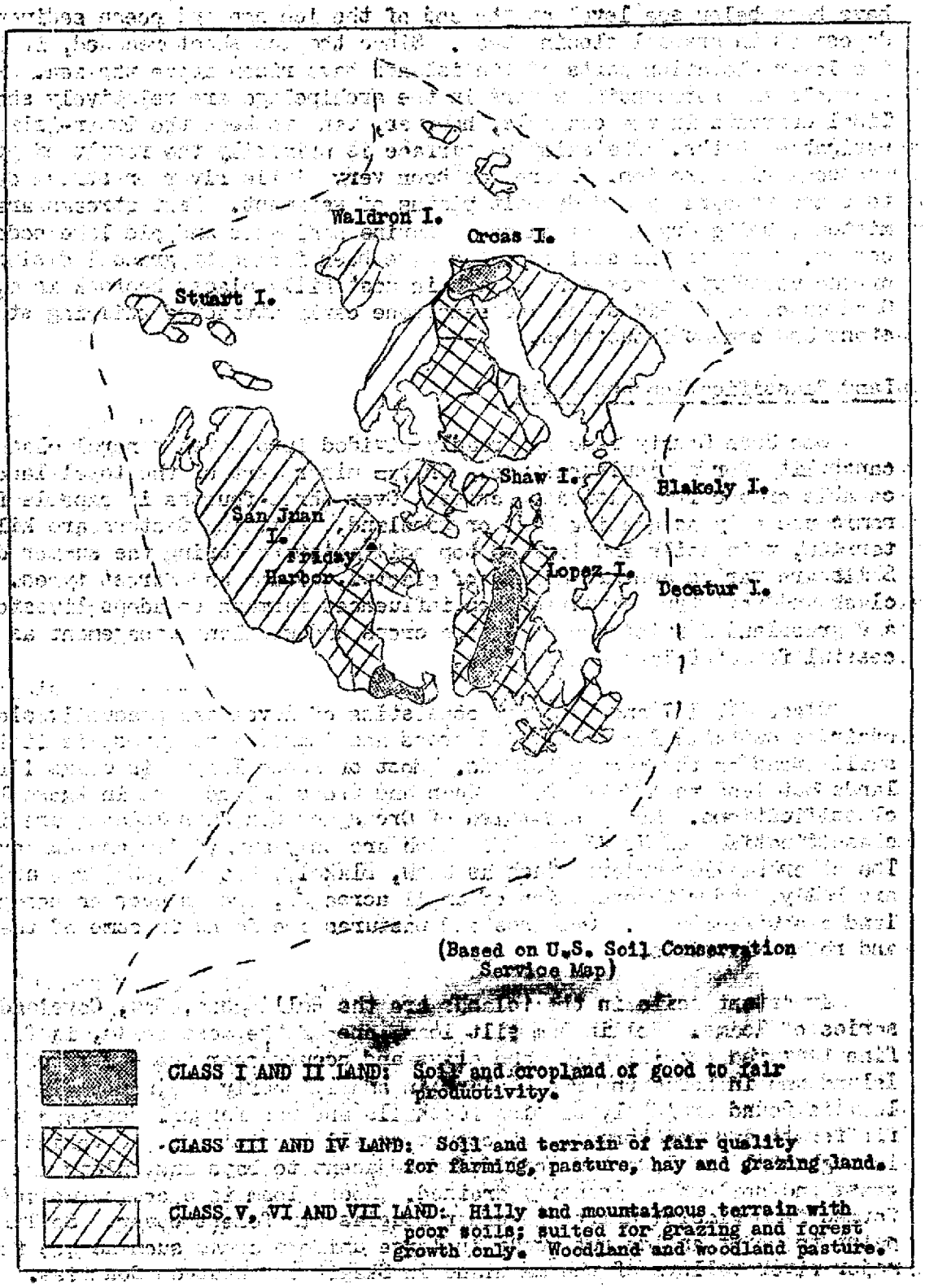

Figure 5.- General Quality of Land For Farming in San Juan County

Climate

San Juan County is located in the West Coast Marine climatic region of North America. It extends along the coast from southeastern Alaska to northern California. Climatologists and geographers describe this climate as one which is influenced by the mild, moist air flowing in from the ocean. The prevailing west winds of ocean air rising over the Olympic and Cascade Mountains bring cool, cloudy and wet conditions for about nine months of the year. During the summer, the land is warm and the winds from off the ocean are heated and do not drop moisture as frequently as in winter. Thus, there is generally a dry period during mid-summer with considerable sunshine to mature crops and provide good harvesting conditions for hay and grain.

The climate is similar to other parts of the world located on the west margins of continents in the belt of the prevailing westerly winds. These include England, northwestern France, Holland, Denmark and Norway in Europe. In the southern hemisphere the same mild, cloudy and wet climate is found in southern Chile of South America and in southern New Zealand. In world regional and commercial geography, the countries located in the West Coast Marine climatic regions are noted for heavy forests which yield lumber and pulp. They are also important for dairy livestock farming.

Climate in the San Juan Islands is predominantly of the marine-type with cool summers, rather mild winters, moist air and a small daily range of temperatures. The islands are in the lee of the Olympic Mountains and the Vancouver Island highlands which protect them from Pacific Ocean storms. Westerly winds are generally descending and warming and precipitating less moisture as they pass over the San Juan Islands. This creates a considerably drier area than is found on the windward side of the Olympic Peninsula and Vancouver Island. The islands are protected fromcold, easterly winds from the continent by the barrier of the Cascade Range. Surrounding maritime waters which seasonally range from 45 to 52 degrees in temperature have a moderating influence on the island area climate. Conditions are favorable for livestock raising, grassland farming and raising of temperature zone field and tree crops.

Precipitation over the islands in general is moderate in yearly amounts and seasonal in occurrence. Weather observers at Olga, Orcas Island, have recorded an average yearly rainfall and snowfall amounting to about 28 inches. At Richardson, Lopez Island, about 25 inches have been recorded while at Friday Harbor, San Juan Island, annual records kept between 1931 and 1943 showed an average of about 27 inches. Precipitation is slightly higher in the higher elevations of Orcas Island. There is a long, wet season from September 1 to June 1 and rainfall and snowfall measure over 4 inches in the month of December. Snowfall is not heavy or common but in some years monthly snowfalls of 5 to 20 inches have been measured. A summer dry season with a high percentage of sunshine is favorable for crops and livestock. Lack of topsoil moisture reduces yields of pasture and some sprinkler irrigation is required during the summer period of the growing season.

Temperatures are mild and extremes occur only on rare occasions. Surrounding ocean waters have a moderating influence on temperatures. There is a prevailing flow of mild ocean air over the islands from the Pacific. Cold

Table 6.- Precipitation By Months, San Juan County

Station and Elevation in Feet	Average Monthly Precipitation (in inches)												Annual Total (inches)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Friday Harbor (100)	4.27	2.70	2.38	1.26	1.21	1.21	.81	.69	1.57	2.43	3.91	4.96	27.40
Olga (80)	3.72	2.77	2.43	1.83	1.58	1.34	.75	.88	1.85	2.80	4.32	4.68	28.78
Richardson (30) 1/	2.57	1.25	2.06	.17	.45	2.14	.49	1.16	2.06	6.36	1.47	5.18	25.36

Source: U.S. Weather Bureau, Climatological Data, Washington, Annual Summary 1954.

Cold, continental air brought by northeasterly winds from the plateaus of British Columbia is uncommon. Midsummer maximum daily temperatures average about 65-70 degrees and midwinter daily low temperatures average about 35 to 40 degrees at the Olga weather station. The highest temperature recorded at Olga was 92 degrees in 1941 and the coldest was 8 degrees below zero in 1950. Killing frosts generally come late in fall during November and occur but rarely after April 1 at Olga. Frost conditions permit a normal growing season of 180 days over most of San Juan County's croplands. Crops which require warm growing weather, however, are not well adapted to the prevailingly mild days and cool nights of the summer season.

Table 7.- Temperature Extremes, Dates of Killing Frost
San Juan County

Station and Elevation in Feet	Temperature Extremes Recorded (degrees Fahrenheit)		Killing Frost Average Dates	
	Coldest	Hottest	Last in Spring	First in Fall
Olga (80)	- 8	92	March 29	November 13
Richardson 1/ (30)	18	75	May 1	December 1

1/ One year record only at Richardson.

Source: U.S. Dept. of Agric., Climate and Man, 1941 Yearbook of Agriculture

Table 8.- Temperatures For Selected Stations, By Months
San Juan County

Station and Elevation in Feet	Average Temperatures (in degrees Fahrenheit)												Annual Average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Olga (80)	39.1	43.4	44.3	48.6	53.2	57.0	59.7	59.8	56.7	50.6	51.9	42.4	49.6
Richardson (30)	37.5	43.9	43.6	47.0	53.1	55.0	57.3	57.7	57.3	51.8	50.2	44.5	49.9

Source: U. S. Weather Bureau

Forest and Wildlife Resources

Most of San Juan County has a Douglas fir forest type of vegetation common to the Puget Sound and Vancouver Island regions. With the exception of some grassland prairies and moors close to the sea, the islands were

originally covered with a mixed-conifer forest in which Douglas fir was the main species and western hemlock, western red cedar, true firs, alder and maple were secondary. Being accessible to the sea, much of the original forest was logged before 1950 and is today replaced with regrowth. Orcas Island has a considerable area of original and regrowth timber in its mountainous district now mainly within Moran State Park. Forests are of high importance in the recreational use of the land, as cover for game birds and animals and as local watersheds.

Forested land covers over 65,000 acres of the 110,000 acres in the county and is primarily in private ownership by individuals, farmers and land holding and timber companies. Farm ownership of woodlands numbered about 175 in 1954. Since 1949 about 5,000 acres of farmer-owned woodlands have been sold for timber and other uses. Public ownership is mainly by the Washington State government, consisting of 4,700 acres of school and other grant lands and about 6,000 acres in Moran State Park.

The harvesting of Douglas fir and other timbers for sawlogs, pulpwood, piling and fuelwood has varied from year to year, but is generally at a rate much reduced from the 1920's and 1940's when island timber was rafted to mills on Puget Sound in large volume. In the Census year of 1954, farmers sold $38,000 worth of forest products, which included 2,187,000 board feet of sawlogs, 1,500 cords of fuelwood, 115 cords of pulpwood and a variety of minor products such as Christmas trees and forest greenery. Over 100 farms have been practicing forest management in recent years as part of their commercial operations. Total log harvest from the islands by farmers and companies was 13,744,000 board feet in 1954. 1/

San Juan County forests, lakes and marine waters are rich in wildlife resources. Because of lack of predators to check their increase, deer and rabbit populations are abundant. Numerous hunters visit the islands and in recent years over 500 head of deer have been bagged per season. There is a year-round season on rabbits and thousands are killed yearly. Grouse, pheasants and quail are also important for sport hunting. Rural and farm families harvest mink, muskrats, raccoons and otters as commercial fur bearers. Fresh water fishing is popular in the six major lakes found on Orcas, Lopez and San Juan Islands. Most of the salt water sounds, bays and channels are popular fishing grounds for salmon, cod, halibut and crabs and many of the ports and seaside resorts have sport fishing for tourist attractions. Salmon Bank is an important commercial salmon fishing area off San Juan Island. Fish canning is an important industry at Friday Harbor.

Table 9.--San Juan County's Rank Compared With Other Washington Counties

Item Compared	Rank	Quantity	Year
General			
Land area	38	110,080 acres	1954
Number of farms	38	295 farms	1954
Land in farms--percent	19	41.3 percent	1954
Average size of farms	20	154 acres	1954
Cropland harvested	34	7,108 acres	1954
Rural farm population	38	998 persons	1950
Total county population	38	3,245 persons	1950
Cash farm income			
Value of all farm products sold	39	641,242 dollars	1954
Value of livestock sold	37	547,772 dollars	1954
Value of crops sold	38	55,205 dollars	1954
Livestock on farms			
All cattle and calves	37	3,970	1954
Milk cows	31	917 head	1954
Hogs	27	1,028 head	1954
Chickens	27	24,285 birds	1954
Horses and mules	38	85 head	1954
Sheep and lambs	9	8,620 head	1954
Dairy and poultry products sold			
Value of dairy products sold	34	72,848 dollars	1954
Whole milk sold	34	951,000 pounds	1954
Value of poultry products sold	24	157,944 dollars	1954
Chickens sold	15	76,247 birds	1954
Eggs sold	24	232,590 dozen	1954
Important crops harvested			
Clover-Timothy Hay	23	2,050 acres	1954
Alfalfa Hay	27	1,050 acres	1954
Grass Silage	13	1,018 acres	1954
Barley	22	880 acres	1954
Oats	26	820 acres	1954

Sources: U. S. Census, Agriculture, 1954.
USDA, AMS, Agricultural Estimates Divn.